Received: 11 December 2020 | Revised: 23 March 2021 | Accepted: 20 April 2021

DOI: 10.1002/vrc2.88

Vet Record CaseReports

CASE REPORT

Companion or pet animals

Bacterial infective stifle arthritis secondary to a migrating grass seed foreign body in an adult dog

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Abstract

An adult neutered male cocker spaniel was presented with a 2- to 3-week history of left pelvic limb lameness, stifle effusion, general malaise and pyrexia. Computed tomography imaging revealed an irregular tubular tract, extending from the stifle distally to the level of the mid tibial diaphysis, associated with the long digital extensor muscle. Ultrasonography revealed the tract had echogenic contents, however, no foreign body could be identified. Following surgical exploration, a grass seed was identified in the medial compartment of the left stifle. Culture of the grass seed and joint capsule tissue yielded growth of *Pantoea agglomerans*. Following the surgery and subsequent antibacterial and non-steroidal anti-inflammatory medication, the dog made a full recovery to normal activity.

KEYWORDS
athritis, dogs, infection, joint diseases, orthopaedics, surgery

BACKGROUND

This case report documents bacterial arthritis of the stifle, secondary to a migrating grass seed foreign body in an adult cocker spaniel. To our knowledge, grass seed foreign body migration to the stifle has not previously been reported in dogs.

Grass seed foreign bodies are common in dogs. The sequelae to grass seed migration are diverse and include epidural abscessation, spontaneous pneumothorax and a urethrovaginal fistula.[1–3] A survey of sites from which grass seeds were retrieved in dogs included the thorax, nasal cavity, ear, head and neck.[4]

A number of reports have documented bacterial infective arthritis secondary to a penetrating foreign body.[5–9] In addition, bacterial infective arthritis can also occur secondary to haematogenous spread and following surgical contamination.[6]

In human literature, the stifle joint has been suggested as a site predisposed for penetrating foreign body injury because of the increased frequency with which this joint is in contact with the ground.[10] In the dog, bacterial infective arthritis is most commonly reported in the stifle joint, however, this is largely secondary to stifle surgery.[11,12]

CASE PRESENTATION

A 6-year-old neutered male cocker spaniel weighing 20.4 kg, with a body condition score of 5/9, was presented with a 3-week history of left pelvic limb lameness, left stifle effusion, generalised left pelvic limb muscle atrophy, diffuse swelling of the tarsus and crus, left popliteal lymphadenopathy, pyrexia, hyporexia and general malaise. The dog had been vaccinated routinely and had no relevant previous medical history prior to the first onset of lameness 3 weeks previously.

INVESTIGATIONS

History at referring veterinary surgeon

Day 1: The dog was initially presented to the referring veterinary surgeon (RVS) with a 48-hour history of deteriorating, severe (9/10) left pelvic limb lameness and malaise. The plantar aspect of the left metatarsal area was diffusely swollen. Haematology and biochemistry blood profiles were normal. Carprofen (Rimadyl, Zoetis) 3.9 mg/kg and clavulanate potentiated amoxicillin (Synulox RTU, Zoetis) 9.44 mg/kg were given by subcutaneous injection followed by a per os course of carprofen (Carprodyl Quadri, Ceva) 3.67 mg/kg SID and clavulanate potentiated amoxicillin (Clavaseptin, Vetoquinol) 18.36 mg/kg BID to complete a 5-day course.

Day 5: The dog was represented with the lameness and malaise which had initially resolved. On re-examination, there was a soft tissue swelling just proximal to the left hock, left stifle effusion and discomfort on manipulation of the left stifle and both coxofemoral joints. Cranial drawer was not present and cranial tibial thrust could not be elicited on tibial compression testing.

Day 6: Following premedication with 0.03 mg/kg acepromazine (ACP, Elanco) and 19 mcg/kg buprenorphine (Vetergesic, Ceva), anaesthesia was induced with 1.47 mg/kg alfaxalone (Alfaxan, Jurox) and maintained with isoflurane (Isoflo, Zoetis). Ventrodorsal and lateral radiographs of the pelvis were normal. Orthogonal radiographs of the left stifle showed increased soft tissue opacity in the stifle joint consistent with effusion (Figure 1).

A stifle arthrocentesis sample yielded turbid sanguinous synovial fluid. This was submitted to an external laboratory for cytology, culture and *Borrelia burgdorferi* PCR.

Following sampling, the dog was discharged home with further 7-day courses of 18.4 mg/kg clavulanate potentiated amoxicillin (Clavaseptin, Vetoquinol) BID, and 1.8 mg/kg carprofen (Carprodyl Quadri, Ceva), SID.

Cytology revealed increased nucleated cell count, predominantly non-degenerate neutrophils, consistent with suppurative arthritis. The culture of the synovial fluid was negative. PCR result for *Borrelia burgdorferi* was also negative.

The 18.4 mg/kg clavulanate potentiated amoxicillin (Clavaseptin, Vetoquinol) BID per os course was extended to cover 5 weeks.

Day 15: The dog did not improve and therefore was referred for further investigation and treatment.

History at Dick White Referrals

Day 19: On presentation, clinical examination revealed a body condition score of 5/9, mild pyrexia of 39.5°C, severe left pelvic limb lameness at walk, left stifle effusion, generalised left pelvic limb muscle atrophy, diffuse swelling of the left tarsus and crus and left popliteal lymphadenopathy. Thoracic auscultation, abdominal palpation and cardiovascular assessment were normal. Moderate pain was elicited on manipulation of the left stifle which had a normal range of motion with no cranial drawer, tibial thrust or patella luxation present. No discomfort was elicited on manipulation of the left tarsus or coxofemoral joint. The right pelvic limb and the thoracic limbs were normal on examination.

Biochemistry profiles showed mild elevations in alkaline phosphatase (141 IU/L, ref. 14-105) and C-reactive protein (52 mg/L, ref. <10). Haematology was normal.

Following premedication with 1 mcg/kg dexmedetomidine (Dexdomitor, Orion Pharma) and 0.2 mg/kg methadone (Comfortan, Dechra) IV, general anaesthesia was induced with 1 mg/kg propofol (Propoflo plus, Zoeits) IV and maintained with isoflurane (Isoflo, Zoetis).

Computed tomography (CT) of the pelvic limbs including the pelvis was acquired, pre- and post-iodinated contrast, loversol (Optiray, Guerbet) 2 ml/kg and reconstructed using bone and soft tissue windows (Phillips MX-16 slice CT). This revealed marked left stifle effusion with marked diffuse thickening and contrast enhancement of the synovium. An irregular, tubular, hypoattenuating, rim enhancing lesion was present which extended from the stifle distally down the limb associated with the long digital extensor (LDE) muscle to the level of the mid tibial diaphysis (Figures 2–4). The left long digital extensor muscle had a diffusely increased volume compared to the right. Left popliteal and bilateral medial iliac lymphadenopathy were noted with moderate diffuse atrophy of the left pelvic limb musculature.

Ultrasonographic examination (US) of the tubular tract on the lateral aspect of the left tibia was acquired by a board-certified radiologist using an iU22 ultrasound system with a linear (7–15 MHz) transducer (Phillips Medical Systems). This revealed the extension of the tract from the mid-tibia proximally to the level of the stifle where it surrounded the tendinous part of the long digital extensor. The material within the tract was echogenic but a foreign body could not be identified (Figure 5).

LEARNING POINTS/TAKE-HOME MESSAGES

- Bacterial infectious arthritis secondary to a migrating foreign body should be considered as a differential diagnosis in cases of unexplained acute and chronic monoarthritis.
- Common imaging modalities are invaluable in identifying secondary changes of surrounding tissues from foreign body migration, however, definitive diagnosis may require surgical exploration.
- If the inciting cause for a bacterial infective monoarthritis is found and removed, a good return to normal function can be expected.

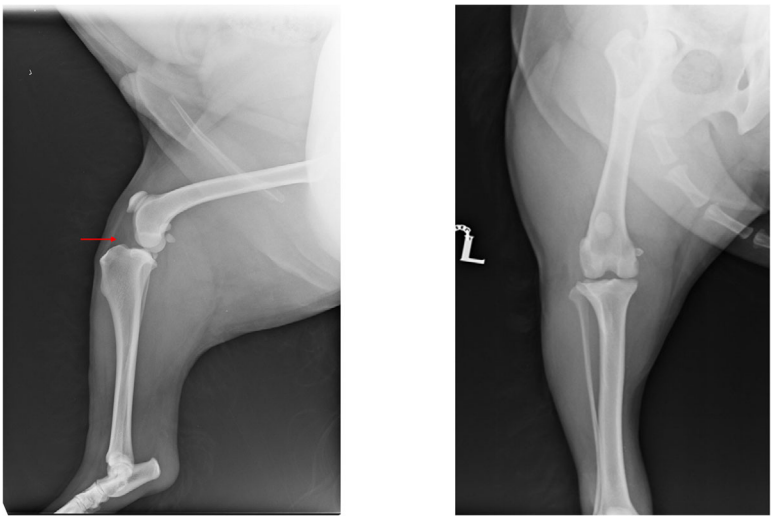

FIGURE 1 Orthogonal radiographs of the left stifle showing increased soft tissue opacity within the left stifle consistent with effusion

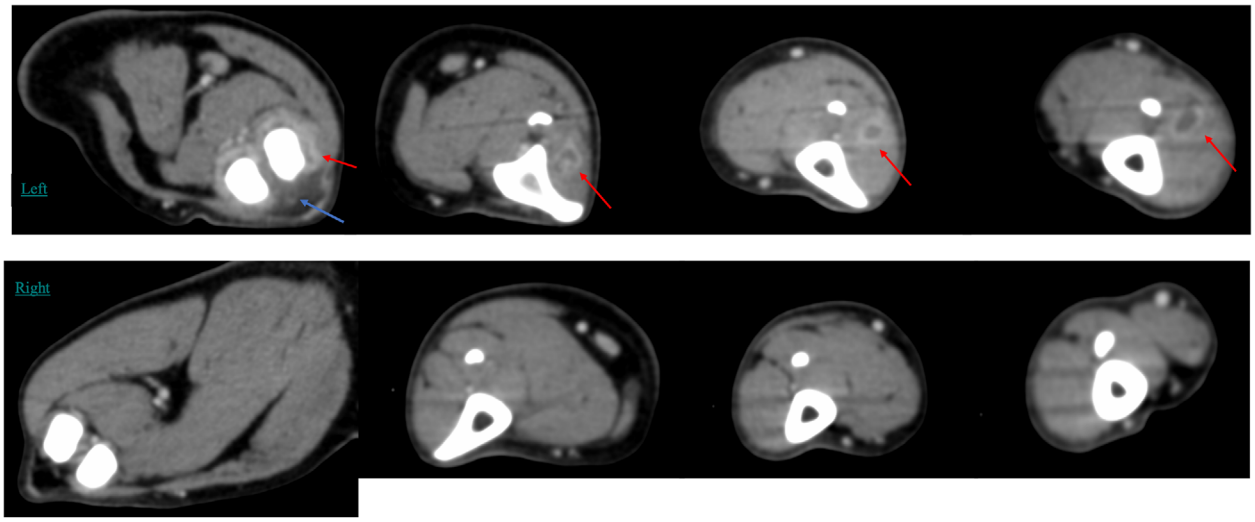

FIGURE 2 Post-iodinated contrast, loversol (Optiray, Guerbet) 2 ml/kg CT images (Phillips MX-16 CT system) reconstructed with a soft tissue algorithm, showing transverse plane images of the left and right tibia and stifles showing a tubular tract (red arrow) associated with the left long digital extensor and left stifle effusion (blue arrow). There is diffuse atrophy of the left pelvic limb musculature

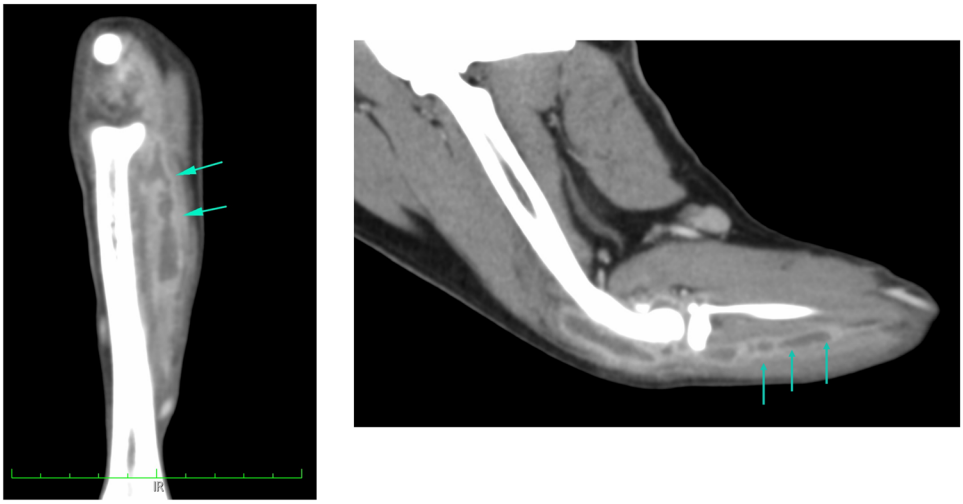

FIGURE 3 Post-iodinated contrast, loversol (Optiray, Guerbet) 2 ml/kg CT images (Phillips MX-16 CT system) reconstructed with a soft tissue algorithm, frontal (left) and sagittal (right) plane images of the left pelvic limb showing tubular tract associated with the left long digital extensor (arrows)

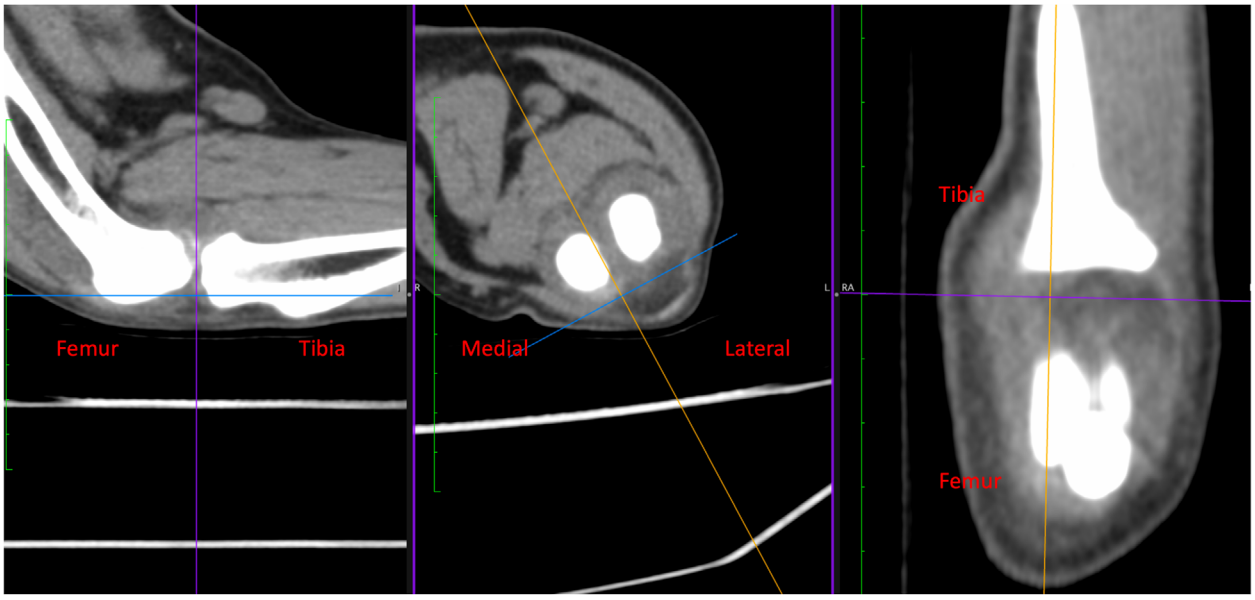

FIGURE 4 Post-iodinated contrast, loversol (Optiray, Guerbet) 2 ml/kg CT images (Phillips MX-16 CT system) reconstructed with a soft tissue algorithm showing 3-dimensional multiplanar reconstruction of the medial compartment of the left stifle

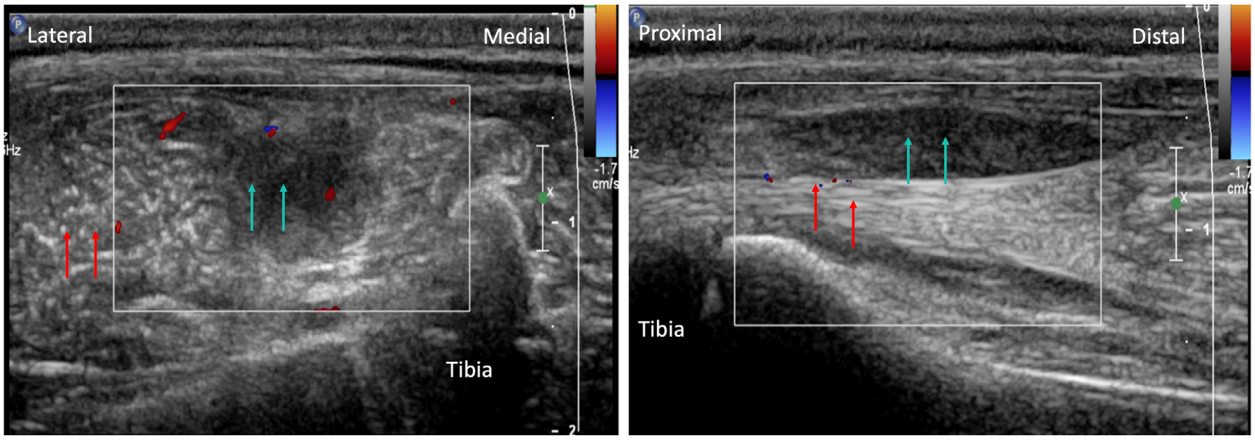

FIGURE 5 Transverse (left) and longitudinal (right) colour Doppler flow ultrasound images (Phillips iU22 ultrasound system, linear transducer, 5–17 MHz) showing a tubular tract (green arrows) associated with the long digital extensor (red arrows) on the lateral aspect of the left tibia extending to the stifle

FIGURE 6 Grass seed foreign body, which had become separated into two distinct segments, removed from the medial compartment of the left stifle

DIFFERENTIAL DIAGNOSIS

In an adult cocker spaniel with pelvic limb lameness showing a temporary response to therapy with antibiotics and non-steroidal anti-inflammatory drugs (NSAIDs), bacterial infective arthritis was an appropriate differential diagnosis.

Cellulitis without a foreign body was also possible, with haematogenous spread and/or spread from surrounding tissues responsible for the bacterial infective monoarthritis.

Immune-mediated monoarthritis (IMMA) or immune-mediated polyarthritis (IMPA) were differentials, and arthrocentesis from other joints could have been considered to rule out an immune-mediated process.

However, the presence of the tract between the stifle and the mid tibial diaphyseal region, no previous stifle surgery, and no osteoarthritic change was strong evidence for a migrating foreign body.

TREATMENT

Following discussion with the owner, the decision was taken to surgically explore the left stifle and associated tract. The surgical procedure was performed under the same general anaesthetic. A lateral parapatellar approach was made to the left stifle and the joint explored. A grass seed, which had separated into two distinct fragments was identified in the medial compartment of the left stifle (Figure 6). The grass seed fragments were removed and submitted along with a representative sample of the joint capsule for bacterial culture. The joint was further explored to ensure no small fragments remained. The thickened long digital extensor tendon sheath was incised, and the tract explored distally with no further foreign bodies found. The joint and tract were both thoroughly lavaged using sterile saline (Aquapharm 1, Animalcare). The joint was closed with monofilament absorbable sutures, 3 metric polydioxanone (PDS II, Ethicon) in a simple continuous pattern. The lateral retinaculum was closed with monofilament absorbable sutures, 3 metric polydioxanone (PDS II, Ethicon), in a cruciate pattern. The subcutaneous tissues were closed using monofilament absorbable sutures, 2 metric poliglecaprone 25 (Monocryl, Ethicon) in a simple continuous pattern. The skin was closed with monofilament absorbable sutures, 2 metric poliglecaprone 25 (Monocryl, Ethicon), in an intradermal pattern. Recovery from anaesthesia was unremarkable.

OUTCOME AND FOLLOW-UP

The dog was discharged the day after surgery with instructions for strict rest for 10 days, followed by 4 weeks of lead restricted exercise of up to 10 min, three times a day. Further oral courses of 1.9 mg/kg carprofen (Rimadyl, Zoetis) BID and 18.4 mg/kg clavulanate potentiated amoxicillin (Synulox, Zoetis) BID for 7 days were prescribed, to be continued until culture and sensitivity results were available.

Culture of the grass seed and joint capsule yielded growth of *Pantoea agglomerans* (Table 1), which was sensitive to the clavulanate potentiated amoxicillin (Synulox, Zoetis) prescribed. The antibiotic course was extended to cover a further period of 6 weeks.

At 3 weeks post-surgery the dog was assessed by video consultation and was making excellent progress with an improving, very mild, left pelvic limb lameness. The dog was examined by the RVS at 6 weeks post-operatively; he was no longer lame, had a normal range of motion with a slight thickening of the left stifle felt on palpation.

At 8 weeks post-operatively the dog was examined again by the RVS. Clinical examination was normal and no pain was elicited on manipulation of the left pelvic limb. No lameness was detected.

At telephone follow-up 21 weeks post-operatively, the dog was reported to be normal with no stiffness and was

TABLE 1 Bacterial sensitivity profile from *Pantoea agglomerans* cultured from grass seed and joint capsule tissue

Antibiotic	Sensitivity	MIC
Amoxycillin	Resistant	
Clavulanate potentiated amoxicillin	Sensitive	2
Cephalexin	Sensitive	8
Cefovecin	Sensitive	1
Doxycycline	Sensitive	0.5
Trimetheprim sulpadiazine	Sensitive	20
Marbofloxacin	Sensitive	0.5
Enrofloxacin	Sensitive	0.12
Pradofloxacin	Sensitive	0.12
Anaerobic culture	No growth	
Fungal culture	No growth	

completing 1 hour unrestricted exercise up to three times a day without noticeable lameness.

DISCUSSION

Grass seed-related disease is a common occurrence in small animal veterinary practice, accounting for up to 2% of hospital presentations.[13,14]

Grass seeds foreign bodies have been reported as causing disease in a number of diverse anatomical locations including the thorax, nasal cavity, ear, head, neck, penis, vagina, spine, shoulder and epidural space.[1,4,9,15,16] To the authors' knowledge, this is the first report of a grass seed migrating to the stifle.

Ultrasound is arguably the most sensitive imaging modality for identification and to guide the removal of grass seeds in dogs.[4,17–19] In this case ultrasound was used in an attempt to identify the suspected foreign body and to facilitate potential removal following the suggestive evidence from CT. However, the stifle joint is a challenging environment in which to locate a foreign body using ultrasound as there is potential for a small foreign body to be obscured by the echogenic artefact created by the bone of the femoral and tibial condyles. Tracts, such as that made by the grass seed in this case, were found in 9 of 24 dogs in one study.[17] In a published case of a penile grass seed, a similar tract, hypoattenuating and with irregular walls, was found in the left cavernous body of the penis, at the level of the caudal border of the os penis.[15] The tract in that case was also first been identified using CT. A study of CT findings in grass seed foreign body cases concluded that CT was most useful for localising secondary lesions rather than definitively diagnosing a grass seed.[4] These conclusions are consistent with this case, where the tubular tract from the grass seed migration was identified on CT, but the seed itself was not.

Bacterial infective monoarthritis can occur due to joint penetration with a foreign object, haematogenous spread, surgical contamination, or spread from surrounding tissues.[11] Most cases develop secondary either to haematogenous spread or surgery.[11] Medical treatment for bacterial infective monoarthritis should be curative where the inciting cause is no longer present.[20] In this case, medical treatment initially failed as the inciting cause was neither identified nor removed. Once the grass seed in the stifle was removed, antibiotics successfully resolved the bacterial infective arthritis.

An early aggressive surgical treatment approach including arthroscopy/arthrotomy and joint lavage has been suggested for treating bacterial infective monoarthritis in dogs, mirroring the approach taken in human and other veterinary cases.[21] The imaging findings in this case raised a high clinical suspicion of a foreign body, although a foreign body tract might have been expected to extend from the entry point, assumed to be the foot. The tract found in this case extended from the mid tibia to the stifle.

In the absence of an identifiable primary lesion following CT and ultrasonographic/ultrasound (US) examinations, a surgical approach was justified to achieve the definitive diagnosis in this case.

Arthroscopic removal of grass seed from the shoulder joint has been reported recently and was considered in this case.[9] There is evidence that arthroscopy is more sensitive at detecting intra-articular pathology compared to arthrotomy, with meniscal tears associated with cranial cruciate ligament disease being detected more effectively via arthroscopy.[22] Arthroscopy may have allowed a minimally invasive thorough examination of the stifle joint in this case. However, the decision for arthroscopy versus arthrotomy for exploration of the stifle (or any other joint) is an individual surgeon preference and experience-driven decision. It is possible that removal of the grass seed arthroscopically would have led to a successful resolution. However, the grass seed had fragmented into two pieces, and there was the possibility of further fragments including in the long digital extensor (LDE) tract where the US had identified echogenic contents. Surgical exploration of the LDE tract was anticipated, and in our view essential. As this was part of our surgical plan, we opted for arthrotomy.

Whilst treatment of bacterial infective monoarthritis is often successful in terms of resolving the infection present, some dogs do not recover full use of the joint, with up to 8% of infections recurring.[12] However, one study reported that of 14 joints that failed to recover from bacterial infective monoarthritis, 13 had an underlying chronic disease process (elbow or hip dysplasia, cruciate ligament failure, or osteochondrosis).[12] The prognosis for a return to normal joint function following bacterial infective monoarthritis is likely to be influenced by any pre-existing disease process. In this case, there was no underlying disease process and as such the prognosis for this dog was good.

Synovial cytology that demonstrates neutrophilic inflammation provides strong supportive evidence of bacterial infective arthritis, but a definitive diagnosis requires either the demonstration of intracellular bacteria or the organism to be cultured from the synovial fluid or membrane.[23] In this case the initial culture of the synovial fluid was negative. Whilst this sample was taken when the dog was receiving clavulanate potentiated amoxicillin (Clavaseptin, Vetoquniol), prior administration of antibiotics is not associated with a decreased efficacy of synovial fluid culture.[24] False-negative results from synovial fluid culture are common, occurring in up to 50% of canine cases.[11,12] The sensitivity can be increased by incubation of the synovial fluid in an enrichment broth, which was used in this case.[25] Synovial membrane biopsy may be a more reliable source of material from which to culture in these cases.[6]

In this case, the focus of infection in the stifle was identified and removed. Following this, a 6-week antibiotic course was prescribed with efficacy subsequently verified by culture

and sensitivity. This treatment duration has been reported previously for the treatment of bacterial infective arthritis and is considered a standard treatment for this condition.[26–29] Without an ongoing focus on infection, a shorter course of antibiotics could have been considered. To our knowledge, no guidance exists to decrease treatment duration following identification and removal of an articular foreign body so in this case standard reported treatment for bacterial infective arthritis was followed.

The isolate grown in this case from the grass seed and joint capsule was *Pantoea agglomerans*; a Gram-negative, aerobic Enterobacteriaceae. This was shown to be sensitive to the potentiated amoxicillin already started (Table 1). A previous survey of isolates grown from grass seed foreign bodies did not identify *Pantoea agglomerans*.[30] Bacteria isolated from grass seed lesions have included *Staphylococcus sp*. from interdigital and periocular lesions, *Escherichia coli* from perianal lesions, *Pseudomanas spp*. from pharyngeal lesions and a variety of anaerobic species from cases of pyothorax.[13] One study looking at respiratory tract grass seeds found that *Staphylococcus spp*. and *Escherichia coli* were the most common isolates.[30] It is likely that isolates reflect both, contamination from the grass seed itself and local bacterial contamination, encountered during the initial wound and migration. *Pantoea agglomerans*, a bacterium associated with plants, has been isolated in humans following penetrating wounds with vegetation such as thorns, wooden splinters and in cases of bacterial infective arthritis.[31,32]

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How to cite this article: Prior S, Arthurs G. Bacterial infective stifle arthritis secondary to a migrating grass seed foreign body in an adult dog. Vet Rec Case Rep. 2021;e88. https://doi.org/10.1002/vrc2.88